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20 MAR 1985

MEMORANDUM FOR: (See Distribution List)

FROM:

Chief, Strategic Resources Division
Office of Global Issues

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SUBJECT:

Cambodia's 1984/85 Rice Crop

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1. The attached memorandum is the follow-up to our preliminary November assessment of Cambodia's rice crop. It provides our estimate of 1984/85 rice production and assesses rainy season rice crop conditions in major growing areas. The paper is based on a comprehensive meteorological data, and collateral reporting.

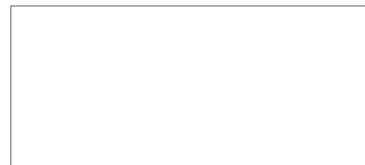
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2. This assessment was produced by Agricultural Assessments Branch, Strategic Resources Division, Office of Global Issues.

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3. Comments and questions are welcome and may be addressed to the Chief, Agricultural Assessments Branch,

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Attachment:

Cambodia: 1984/85 Rice Shortfall,
GI M 85-10078, March 1985

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SUBJECT: Cambodia's 1984/85 Rice Crop [REDACTED]

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OGI/SRD/AAB, [REDACTED] (March 1985)

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Central Intelligence Agency

Washington, D.C. 20505

DIRECTORATE OF INTELLIGENCE

20 March 1985

Cambodia: 1984/85 Rice Shortfall

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Summary

Based on a comprehensive analysis of [] meteorological data, and collateral reporting, we estimate that Cambodia's 1984/85 rice harvest (rainy and dry season) will reach 1.4 to 1.5 million metric tons (mmt). A crop of this size, down from last year's reported output of almost 1.7 mmt, would be the smallest since 1979/80. []

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The entire shortfall is from the rainy season rice crop--estimated to be 1.2 mmt--which suffered losses in both yield and hectareage primarily as a result of flood damage. By comparison, abundant water reserves and better seeds augur well for an increase in output of dry season rice--still being planted. []

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Our estimate of rainy season rice is considerably larger than that of the Heng Samrin government, which, when requesting food aid from the Food and Agriculture Organization of the United Nations, claimed that damage from adverse weather would cut production by 40 percent to below 900,000 metric tons. Evidence from [] meteorological data pointed toward a downturn of only half that magnitude. []

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Despite a smaller rainy season rice crop, we do not expect widespread, serious food shortages in Cambodia during the coming months. A harvest of 1.4 to 1.5 mmt would result in a milled rice deficit of roughly 190,000 to 245,000 metric tons, based on minimum rations for an estimated population of 6.5 million. We believe, however, that a substantial part of this deficit will be made up by substituting other foods. We do not expect the recent exodus of refugees from camps along the Thai-Cambodian border to substantially alter the demand for food. Most of these refugees have already been provided food assistance by United Nations and voluntary agencies. []

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This memorandum was prepared by [] Agricultural Assessments Branch, Strategic Resources Division, Office of Global Issues. Comments may be directed to [] Chief, Strategic Resources Division, []

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GI M 85-10078

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Cambodia: 1984/85 Rice Shortfall

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Introduction

We estimate that Cambodia's 1984/85 rice production (rainy and dry season) will reach 1.4 to 1.5 million metric tons (mmt), down from the announced 1983/84 level of almost 1.7 mmt, and the smallest output in the past four years. (Table 1). The projected shortfall is based mainly on evidence from reconnaissance and Landsat imagery which revealed widespread flooding. This hurt prospects for the crucial rainy season crop--estimated at 1.2 mmt--by reducing the rice area and lowering yields. Nevertheless, we believe that the crop was not as severely devastated as the Phnom Penh regime claimed when requesting food aid from the Food and Agriculture Organization (FAO) of the United Nations. The rainy season rice harvest is drawing to a close, and prospects for the dry season rice crop--usually about 10 percent of the total--are much brighter because irrigation water is abundant and better seeds are available. Depending primarily on the size of the area sown by the end of March, we believe output could range from 216,000 to 320,000 metric tons, up from the 208,000-metric-ton harvest announced last year.

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Sowing and harvesting operations in Cambodia extend through most of the year because the country uses many rice varieties with different length growing seasons. The timing of monsoon rainfall and the extent of the area flooded greatly affect the pace of sowing and the total area planted from year to year. Rainy season rice, accounting for 90 percent of annual production, is planted from June through November, and the bulk of harvesting takes place from December through February. Dry season rice, grown only in a few provinces, is planted from November through March, for harvest from February through April. The area devoted to dry season rice depends on the extent of monsoon flooding. Rainy season rice yields¹ average 1.1 metric tons per hectare, and dry season rice yields average 1.6 metric tons per hectare, due to more sunlight, more controlled watering, and less disease. Because overall rice yields in Cambodia do not vary much from year to year, the fluctuation in rice hectarage--caused largely by the extent of flooding--is the major factor behind annual production variability.

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Milled Rice Requirements and Availability

Assessment of whether a total rice crop of 1.4 to 1.5 mmt

¹ Cambodia's rice yields have traditionally been poor in relation to other countries. A labor force with low technical skills, shortages of draft animals, fertilizer, seeds and equipment, and a deteriorated irrigation network contribute to low yields.

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will result in serious food shortages in Cambodia is complicated by the lack of an exact population figure for the country and by disagreement on the size of an "adequate" ration.² While Phnom Penh states that the population is 7.2 million, such a figure seems too large in relation to the same government's claim that millions were killed during the Pol Pot regime. A May 1981 census figure of 5,746,141, in line with the CIA estimate of 1981,³ was announced in the press, and leads us to conclude that the population is currently between 6 and 7 million. The following tables show the amounts of milled rice⁴ required by Cambodia to support varying sized populations at two minimum ration levels, as well as the amounts of milled rice available from both the announced 1983/84 crop and from our estimate of the 1984/85 crop:

Milled Rice Requirements

<u>Population</u> <u>(million)</u>	<u>Milled Rice (metric tons)</u>	
	<u>12 kg/mo (FAO)</u>	<u>14 kg/mo (Phnom Penh)</u>
6.0	864,000	1,008,000
6.5	936,000	1,092,000
7.0	1,008,000	1,176,000
7.2	1,036,800	1,209,600

Milled Rice Availability

<u>Total Rice Crop (metric tons)</u>	<u>Milled Rice (metric tons)</u>
1,675,000 (1983/84)	896,963
1,536,000 (1984/85 high estimate)	822,528
1,432,000 (1984/85 low estimate)	766,836

² The FAO uses, as a minimum emergency ration, an individual rice requirement of 12 kilograms per month. While such a ration will sustain life, it is not sufficient for persons doing farm labor. Phnom Penh has stated a minimum requirement of 14 kilograms per month. An 18 kilogram monthly ration is considered the ideal amount to support physical labor.

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³ The CIA estimated Cambodia's population at 5.6 million as of 1 January 1981.

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⁴ To calculate the amount of milled rice available from total rice production, a 15 percent seed and loss factor is subtracted, and the remainder is multiplied by a .63 milling factor.

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Using a population of 6.5 million, and a milled rice ration of 13 kilograms per month--midway between the FAO and Phnom Penh estimates of an adequate ration--our projected 1984/85 rice output would result in a milled rice deficit of roughly 190,000 to 245,000 metric tons. [REDACTED]

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While this crop season's output of milled rice will be below the minimum requirements to sustain the estimated population, we believe that Cambodia's food problem will be less serious than our estimated rice shortfall would imply. This is because rice rations can be supplemented by other food crops, fish, and game. Using Phnom Penh's 1984/85 production estimates for corn, cassava, and sweet potatoes, over 56,000 metric tons of milled rice equivalents could be added to rations, thereby cutting our estimated rice deficit to approximately 135,000 to 190,000 metric tons. Other crops, such as vegetables, bananas, sugar, and coconut will also alleviate some rice shortages. [REDACTED]

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In our view, the food problem in Cambodia will not be a major cause of further exodus of refugees to Thailand. Furthermore, the recent outflow of refugees from camps along the Thai-Cambodian border--as a result of the heavy fighting--will not substantially alter the demand for food. Most of these refugees have already been provided food assistance by United Nations and voluntary agencies. [REDACTED]

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1984/85 Crop Season

Cambodian radio broadcasts, agricultural data provided by Phnom Penh to the FAO, and international press reports have indicated that drought in July and August, followed by sudden, heavy floods in August and September, would cut output of the critical 1984/85 rainy season rice crop to below 900,000 metric tons, some 40 percent less than a year ago.⁵ According to these reports, sowing targets were not fulfilled and most areas suffered damage from both drought and floods (Table 2). [REDACTED]

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Although our analysis of [REDACTED] meteorological data, and collateral reporting corroborates the Cambodian claims of a rice shortfall, we believe that the magnitude of the downturn was substantially smaller. Specifically, we estimate rainy season rice production at 1.2 mmt, roughly 20 percent below the 1983/84

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⁵ The Cambodian regime also made claims of a serious rice shortfall during the 1983/84 crop season, citing drought and flood damage similar to this year's reports. Provincial sowing totals, however, reached planned levels and some reports from Cambodia, Vietnam, and the Soviet Union put rice output as high as 2.0 million tons compared to almost 1.7 million tons officially announced. [REDACTED]

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[redacted]

level. While we were able to confirm [redacted] serious flood damage in some areas, neither imagery nor meteorological data showed evidence of widespread or prolonged drought conditions. Because of the paucity of weather data and the lack of comprehensive [redacted] from June through October, however, we cannot rule out the possibility that part of the hectareage shortfall resulted from dry weather during the sowing campaign. [redacted]

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Weather Problems. We believe that Phnom Penh's assessments of weather problems overstate the amount of rice destroyed. Cambodian reporting--mainly broadcasts and appeals for food aid--gives contradictory descriptions of weather conditions, and the hectarages affected, and counts damaged areas as completely destroyed. This alarmist and contradictory reporting has been typical of past agricultural commentary from Cambodia. Some typical weather reports this year included the following:

- o June -- Rainfall was slightly below average until the end of June.
-- Serious drought threatened almost every region.
- o July -- The second half of July was dry.
-- Rainfall occurred everywhere and conditions were excellent in mid-July.
- o August -- All of August was dry.
-- During the first half of August rainfall was sufficient and was four times last year's level, but despite these favorable conditions peasants should prepare irrigation networks in case a drought occurs.
-- Serious Mekong River floods destroyed rice.
- o September -- Floods damaged and destroyed rice, but efforts should be made to make up these losses.
- o October -- Drought since mid-season has occurred in 14 provinces.
-- Floods in several provinces damaged rice.

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[redacted]

Equally as inconsistent were the reports describing the number of hectares of rice affected by adverse weather. The amount of rice "destroyed" by drought and/or flood ranged from a worst case of 463,400 hectares (236,000 hectares from drought and 227,400 hectares from flood) to a minimum of 224,300 hectares (24,300 hectares from drought and 200,000 hectares from flood). Other comments claimed that the area of rice "affected" by drought ranged from 47,000 to 260,000 hectares. One report described floods as causing "losses" on 224,000 hectares.

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Finally, some provincial reports referred to rice "destroyed" on one date as "damaged" on a later date. [REDACTED]

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Analysis of US Air Force weather data of Southeast Asia points to a generally normal 1984 monsoon for the region, with little or no indication of severe drought, but with flood conditions existing in Cambodia from August through November.⁶ Plentiful rainfall in neighboring Thailand, Laos, and Vietnam makes it highly unlikely that Cambodia experienced a dryspell of sufficient duration to have caused major crop destruction.⁷ By comparison, flood damage confirmed on November Landsat imagery was caused primarily by two factors. First, abundant monsoon rainfall (totalling over 3,000 mm at some stations, or 1,000 mm above normal) in northeast Thailand resulted in excess water running off into the upper Mekong River. Second, heavy rains also occurred in the lower Mekong watershed area in Vietnam, which caused the water level in the delta to reach capacity in August. With no place for the heavy water flow coming from the upper Mekong to go, widespread flooding occurred in Cambodia's southern provinces. [REDACTED]

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Decrease in Rice Hectarage. We estimate that only 1.2 million hectares of rainy season rice will be harvested this year, nearly a 10 percent decrease from the 1.4 million hectares reportedly harvested in 1983/84.⁸ Our estimate is based on the latest available provincial sowing reports, which show that, in contrast to last year, all but one of the twelve major rice producing provinces failed to achieve planned hectarages. A

⁶ Rainfall totals from weather stations inside Cambodia are not available, so data from surrounding countries are used. Rainfall within Cambodia does not always indicate the flood situation because floods often result from heavy rains in mountainous areas outside Cambodia. [REDACTED]

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⁷ Laos reportedly had a record 1984 rice crop and Vietnam announced that 1984 rice output equalled that of 1983, though falling short of plan. [REDACTED]

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⁸ National level statistics show 1,570,000 hectares sown and 1,358,000 hectares harvested in 1983/84. Provincial level data give a sown area of 1,663,000 hectares, but only fragmentary harvested area figures. [REDACTED]

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[redacted] survey⁹ of 10 of the 12 major rice producing provinces, showed that, on average, about 70 percent of the rice paddies were active this year compared to about 80 percent last year. We reduced the 1,292,700 hectares reportedly sown to account for flood-destroyed rice in five provinces covered on Landsat imagery. The destroyed area, however, is estimated to be only about 56,000 hectares, less than 5 percent of the total rice area. The Cambodian regime, on the other hand, reported a disastrous decline in rainy season rice area. It presented a FAO consultant with data that takes a sown area of nearly 1.3 million hectares and subtracts 463,400 hectares for rice destroyed by drought and flood, leaving an area of 836,400 hectares to be harvested. Such a 40 percent decrease from last season is not supported by either imagery or weather data. [redacted]

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Decrease in Rice Yields. Analysis of [redacted] Landsat imagery indicates that the rice crop was in worse condition than in 1983/84. The bulk of the crop damage observed, however, appeared to be the result of flooding, and not--as claimed in the press--the result of both drought and floods. Although most of the flood waters had receded, imagery showed standing water in some fields and water damaged crops in many others. Moreover, we found no evidence to indicate that the effects of adverse weather were widespread or severe enough to have damaged as much rice as had been reported in the Cambodian press and other collateral reporting. For example, in all but one province, where destruction appeared to be roughly 20 percent of the sown area, total devastation of rice fields is estimated to be only about five percent or less. [redacted]

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⁹ Our estimate of the 1984/85 Cambodian rainy season rice crop is based on a statistically valid sample survey [redacted]

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[redacted] from 9 of 10 selected areas, which include 10 provinces from within the country's main rice producing regions (Figure 1). The survey involved placing computer-generated overlays, each having 100 random points, on cloud-free imagery acquired from November 1984 through early January 1985 and assigning the land at each random point to one of the following landuse categories:

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- o Fallow or abandoned fields
- o Flooded fields
- o Other (harvested ricefields, plowed fields, and field crops other than rice)
- o Active rice paddies, then categorized as in good, fair, or poor condition
- o Nonagricultural land

The total number of fields in each agricultural category was used to derive the percentages shown in Table 2. [redacted]

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[redacted] survey was used to assess conditions within individual rice fields. The survey showed that:

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- o The percentage of active rice fields rated as good fell to 20 this year from 45 in 1983/84.
- o Rice fields rated fair in 1984/85 increased to 57 percent, compared to 28 percent a year ago.
- o The percentage of fields judged to be poor was virtually the same for both years. [redacted]

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We were able to supplement [redacted] sample areas with Landsat imagery, which covered virtually all of Cambodia's main rice region from late November through early January. Landsat-- [redacted] --helped us refine yield estimates derived from meteorological data [redacted]. It also provided the key information that five provinces in the south had sustained major flood damage (Photo A), and showed generally healthy rice elsewhere in Cambodia. [redacted]

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Regional Rice Assessment

Prey Veng and Siemreab-Otdar Meanchey, which account for 25 percent of the current rice area, appeared hardest hit by flood damage, with rice yields expected to be only 0.8 metric tons per hectare, well below Cambodia's recent average of 1.1 metric tons per hectare. Almost all of the fields here were judged to be fair or poor, with thin stands barely visible against the soil background. By comparison, last season's imagery survey of the two provinces assessed over half of the rice as good. Moreover, we reduced Prey Veng's hectareage by 20 percent as a result of flood damage seen on Landsat. [redacted]

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Other damaged provinces, covering 23 percent of the rice area, include **Kandal, Kampong Cham, Svay Rieng, and Pouthisat**, where we expect yields of 0.9 metric tons per hectare. Major flood destruction observed on Landsat imagery of Kandal prompted us to cut its rice area by 7 percent. Similarly, Kampong Cham sustained an estimated 5 percent loss of rice from flooding (Photo B), but also had areas where as much as 75 percent of the rice was rated in the good category (Photo C). [redacted]

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[redacted] Svay Rieng showed signs of heavy flood damage [redacted] with 95 percent of the rice rated fair and poor (Photo D). Pouthisat's rice paddies did not show much direct evidence of flood damage, but 90 percent were in fair and poor shape. In last season's [redacted] survey, at least one half of the rice paddies in these four provinces were judged to be in good condition. [redacted]

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In **Kampong Thum and Kampong Spoe**, which contain 12 percent of the rice area, we estimate yields to be about 1.0 metric tons per hectare. Landsat indicated that 5 percent of the rice in Kampong Thum was destroyed by floods, but 76 percent of the crop

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was categorized as fair [redacted] Kampong Spoe, which reportedly experienced drought, was observed on Landsat to have a fair crop. Last year's [redacted] indicated heavy flood damage in Kampong Thum. Kampong Spoe, however, was not [redacted]

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Better crop conditions were evident in **Batdambang**, **Takev**, and **Kampong Chhnang**, which together contain 27 percent of Cambodia's rice fields. Yields here are likely to reach the average level of 1.1 metric tons per hectare. Most rice in Batdambang was in fair shape, but some areas of very good rice, [redacted] were noted (Photo E). The reported flood damage was not observed. Although 15 percent of Takev's rice paddies were rated as good and 83 percent fair, we reduced hectareage by 5 percent to account for flood destruction seen on Landsat. Kampong Chhnang's rice was assessed as 31 percent good and 54 percent fair, with dense, even stands. All three provinces, however, had higher proportions of good rice in last year's [redacted]

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The best overall rice conditions were found in **Kampot**, where yields are projected to reach 1.3 metric tons per hectare. Because the province contains only 8 percent of the country's rice area, the good yields there will be more than offset by poorer prospects elsewhere. [redacted] 34 percent of the province's rice was good and the remainder fair due to minor water damage (Photo F). Kampot had reported only one instance of "unfavorable" weather--without specifying drought or flood--and it was the only major province to report fulfillment of its sowing plan. Even so, more of the province's rice was rated as good [redacted] than in the current one. [redacted]

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Outlook

With the rainy season rice harvest now drawing to a close, little, if any, additional damage from adverse weather is likely. By mid-January--the latest date for which a country-wide harvest report is available--harvest operations had passed the half-way point, and analysis of subsequent weather and collateral reports suggests that farmers encountered few problems in gathering the rest of the crop. Although a small but varying percentage of the sown area fails to be harvested each year, we believe that every effort was made to harvest the entire 1.2-million-hectare area in light of the losses sustained earlier in the season. [redacted]

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Because planting of the dry season rice crop is still underway, the size of this crop cannot yet be estimated precisely. This year's plan of 190,000 hectares is ambitious, but the shortfall in rainy season rice production should spur sowings of 120,000 to 160,000 hectares. Abundant water reserves combined with increased availability of high-yielding IR-36 hybrid rice seeds could boost yields to 1.8 - 2.0 metric tons per

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hectare, resulting in dry season rice production ranging from
216,000 to 320,000 tons, up from last year's output of 208,000
metric tons.



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Table 1

Cambodia: Rice Crops ^a					
	1980/81	1981/82	1982/83	1983/84	1984/85
<u>Rainy Season Rice</u>					
Planned area (thousand hectares)	1,500	1,700	1,600	1,600	1,700
Harvested area (thousand hectares)	1,232	1,300	1,545	1,358 ^b	1,237
(% of plan)	82%	76%	97%	85%	72%
Yield (metric tons/hectare)	1.19	1.0	1.16	1.08	.98
Production (thousand metric tons)	1,466	1,300	1,788	1,467	1,216
<u>Dry Season Rice</u>					
Planned area (thousand hectares)	123	150	165	155	190
Harvested area (thousand hectares)	88	149	135	105 ^c	120-160
(% of plan)	72%	99.6%	82%	68%	63-84%
Yield (metric tons/hectare)	1.30	1.7	1.6	1.79	1.8-2.0
Production (thousand metric tons)	115	256	216	208 ^d	216-320
<u>Total Rice</u>					
Planned area (thousand hectares)	1,623	1,850	1,765	1,755	1,890
Harvested area (thousand hectares)	1,320	1,449	1,680	1,463	1,357-1,397
(% of plan)	81%	78%	95%	83%	72-74%
Yield (metric tons/hectare)	1.20	1.07	1.19	1.14	1.06-1.10
Production (thousand metric tons)	1,581	1,556	2,004	1,675 ^e	1,432-1,536

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^a Area, yields, and production for 1980/81 are FAO estimates, and the same data for 1984/85 are CIA estimates. All other data are from Cambodian announcements. Numbers have been rounded.

^b The 1,358,000-ha harvested area is based on 1,570,000 ha sown, with a subtraction of 212,000 ha damaged. Provincial sowing figures, however, show a total area of 1,663,000 ha.

^c The 105,000-ha harvested area is based on 116,000 ha sown, with a subtraction of 11,000 ha damaged. Incomplete provincial sowing figures, however, show a total area of 120,000 ha.

^d Using the area and yield shown, dry season production would be 188,000 tons instead of the 208,000 tons reported.

^e Other reports from Cambodia, Vietnam, and the Soviet Union put 1983/84 production at 2.0 million tons from an area of 1.7 or 1.8 million hectares.

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Table 2

Cambodia: 1984/85 Rainy Season Rice

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Province	1983/84 rice area ^a (ha)	1984/85 rice area ^a (ha)	CIA Est. Yield ^b (mt/ha)	CIA Est. Production (mt)	Reported Weather Conditions ^c	Sampled Data ^d			
						Active Rice Paddies(%)	Good Rice (%)	Fair Rice (%)	Poor Rice (%)
Batdambang	291,000	179,900	1.1	197,900	floods	87	16	69	15
Prey Veng	246,300	149,800 est.	.8	119,800	drought, floods	86	10	50	40
Siemreab-Otdar									
Meanchey	163,000	155,000	.8	124,000	drought, floods	45	0	21	79
Kampong Cham	158,000	124,100 est.	.9	111,700	floods	69	75	25	0
Takev	135,200	108,300 est.	1.1	119,100	drought, floods	87	15	83	2
Svay Rieng	130,000	82,200	.9	74,000	drought	88	5	60	35
Kampong Thum	105,000	90,300 est.	1.0	90,300	drought, floods	65	2	76	22
Kampot	96,900	95,900	1.3	124,700	unfavorable	86	34	66	0
Kampong Spoe	75,000	57,500	1.0	57,500	drought	--	--	--	--
Pouthisat	75,200	51,000	.9	45,900	drought, floods	50	10	64	26
Kandal	52,000	30,300 est.	.9	27,300	floods	--	--	--	--
Kampong Chhnang	48,500	40,100	1.1	44,100	floods	59	31	54	15
Other ^e	86,800	72,200 est.	1.1	79,400	floods	--	--	--	--
Total	1,662,900	1,236,600	.98	1,215,700					

^a Data are from broadcasts, press, and embassy reports. Areas were estimated for provinces which did not report recent sowing progress, and a reduction in area for 1984/85 was estimated for five provinces which suffered severe flood damage as indicated by Landsat imagery. Numbers have been rounded.

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^c According to embassy and press reports, and broadcasts.

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^d The first column gives the percentage of active rice paddies to the total number of fields sampled. Fields were classified as rice, fallow-abandoned, flooded, harvested, plowed, or a non-rice crop. Besides active rice fields, however, only fallow-abandoned fields were observed in significant numbers.

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^e Includes Kracheh, Preah Vihear, Rotanokiri, Stoeng Treng, Kaoh Kong, Mondol Kiri, and Kampong Saom and Phnom Penh municipalities.

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